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ABSTRACT

This paper argues that: (1) technology with its ability to individually tutor each child has rendered the blackboard classroom based on group teaching obsolete; (2) state leaders must provide the initiatives it will take for America to make the transition to the technology-driven classroom by the year 2000; and (3) a significant portion of the costs of this transition can be met through a partnership between states and the regulated utilities industry. Dynamics that occur in the computer classroom are noted, as well as some advantages of networked classrooms. A program established by a Maryland-based utility--Potomac Edison--is then described. This program has resulted in the establishment of partnerships with the departments of education in the utility's three-state service area--Virginia, Maryland, and West Virginia--and the placing of technology-based classrooms in the 23 school districts (mostly rural) served in these states. The "penny a day" financing that influenced the development of this project is described as an example of the relationship that can exist between states, business and industry, and schools. It is noted that Potomac Edison has also established a teacher training center at its corporate headquarters and equipped a mobile van with a 30-station classroom for training and demonstrations. The story of an eighth grade student's success in winning a CAD (computer-assisted design) state championship after studying in one of the schools participating in the program concludes the paper. (DB)

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Helping Put Technology into Classrooms for Less Than a Penny a Day

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1990

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Helping Put Technology into Classrooms for Less Than a Penny a Day

Elmer Kaelin

The traditional blackboard classroom is obsolete, say Elmer Kaelin, who served as president of the Maryland-based utility Potomac Edison for nine years before heading up the Legislative Work Conference of the Southern Regional Education Board. Mr. Kaelin says American classrooms must become technology centers, and students must spend significant time actively engaged with computers. Mr. Kaelin, who serves on both the Maryland State Board of Education and the Maryland Higher Education Commission, explains how Potomac Edison established high-tech classrooms in its three-state service area and describes a novel financing method to help states make the transition to computer-supported classroom teaching.

My call today is a call for action—action to implement a plan in your states that will help transform American education within the next 15 years.

I hope to convince you of three things: first, that technology with its ability to individually tutor each child has rendered the traditional blackboard classroom obsolete. Second, I hope to convince you that state leaders must provide the initiatives it will take for America to make the transition to the technology-driven classroom by the year 2000. Finally, I want to convince you that there is a way to help pay a significant portion of the costs of this transition through an intriguing partnership between states and the regulated utilities industry.

In my opinion, the most important partnership that business and education can pursue is to carry out the vision and the mission set forth in the 1986 report by the National Task Force on Technology, *Transforming American Education: Reducing the Risk to the Nation.* This important report was a follow-up to the *A Nation at Risk* study which awakened all of us to the plight of K-12 education in this country.

The report provides real insight into what we must do as a nation to meet the challenges of today's and tomorrow's global society. The path to excellence requires new tools—tools that will recreate, rekindle, and renew the thinking necessary to produce the quality work force this nation will require to succeed in today's competitive world. "There is no easy path to excellence," the task force report states, but "educational technology gives us a powerful tool—more powerful than we have ever had—to traverse that path expeditiously."

Reform Requires New Tools

Reforms predicated on more time in the classroom, revised course content, and stricter discipline will not by themselves produce the desired results. We must give teachers the tools to help each student reach his or her full potential. Computer-aided instruction allows the teacher to adapt learning to the needs of each student. Computers provide corrective advice and allow the student to proceed at his or her own learning pace. Most students like working with computers; they find the process stimulating and motivating.

Yet most of our schools are not using this extremely powerful instructional tool as an integral part of the curriculum. In July, we had

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a teacher from the center city of Baltimore — a science teacher—come before the Maryland State Board of Education and testify about the way she was forced to teach science. She was teaching the DNA molecule. She cut out paper elephants and linked the tail of one to the trunk of the next. She was trying to get across to her students the thought that the DNA molecule was a chain.

This same teacher went on to explain how by computer—just one computer—she could graphically demonstrate this molecule on a video screen which she could project for the entire class to see. If she had a computer and a light pen for every student, she could have them construct the molecule themselves.

Today, in the most technologically advanced nation in the world, we have a science teacher who is forced to use paper elephants to teach the DNA molecule. We should all be ashamed.

Inside the Technology-Driven Classroom

I repeat: The blackboard classroom based on group teaching is obsolete. We must move rapidly to a redesigned technology-driven classroom with computer interactive instruction that provides students with a one-to-one learning ratio. Some of you may never have visited such a classroom, so let's look briefly at what it is.

First of all, each student has his or her own individual computer. The success of this classroom depends first on good hardware and software served off a network, a well-trained teacher, and strong support from principals and superintendents.

The configuration of the technology-oriented classroom is different. First of all, the teacher is behind the students instead of in front of them. This is just one of the very difficult adjustments that the teacher has to make in moving from the blackboard classroom to the electronic classroom. Obviously, there are many others.

In these classrooms, the students move at their own pace. This produces a remarkable dispersion. For example, in a fourth-grade classroom, you will have a spread from about the third grade to the seventh grade. Students who excel in one subject or fall behind in another can still remain with their peers—they're not flunked or forced to waste time on material they have already mastered.

Who is tutoring these students? When I asked this question of witnesses who came before the State Board in Maryland, I got all sorts of answers. Some said "the computer." It is true that the concept of a "teaching" machine first appeared in the literature in 1925, but the computer is not really doing the teaching. The next answer I got was "the programmer." Well, it is not the programmer, either.

"The blackboard classroom based on group teaching is obsolete. We must move rapidly to a redesigned technology-driven classroom with computer interactive instruction. . . ."

Who is really doing the teaching? The front-line instruction is provided by some of the finest teachers in America—individuals who have drawn on their many years of experience and reduced their work product to curriculum in software form. Why must it be the finest teachers in America? Because the concepts of teaching and learning do not change as you move from the blackboard classroom to the computer class—at least not initially.

Students Concentrate and Cooperate

What we are altering is the delivery system. Teachers have noted significant changes in their students. Their students concentrate harder; they complete more work. They have a greater

attention span; they are better behaved. They have a better attitude toward school when compared to students whose experiences are in the traditional blackboard classroom.

Another interesting dynamic that occurs in the computer classroom is cooperative learning. Teachers report that when students get stuck, they try to solve the problem themselves. If that doesn't work, they turn to the student on their right and have a little conference. The student on the right is rarely at the same place, because each student is moving at his or her own pace, but the student can often help solve the problem. If not, the student on the left may have the solution. The last thing the student does is ask the teacher.

Cooperative learning has many benefits. It fosters problem-solving skills and frees the teacher to give additional attention to individual students. In the electronic classroom, the teacher has free time because she no longer delivers the lesson. She is able to move from station to station, monitoring each child's progress. Allowing more time for instruction is the very thing that most teachers cite as the number one way to help them do their jobs better.

In the networked classroom, the software provides a report that teachers can use at any time to measure a student's progress. Every response a student makes is recorded by the management system that resides on the network. Teachers can see exactly what each student is doing. This capability has produced a revolutionary improvement in computer instruction. It enables the teacher to create and adjust individualized learning plans for each student on a daily or weekly basis. As one teacher put it, "This system eliminates special education because every child is specially educated."

Potomac Edison's Model Partnership

Now that you have some idea of what an individually tutored classroom looks like, let me tell you about the critical role that state leaders played in helping Potomac Edison create a model school-business partnership built around the "high-tech" classroom.

While most educators and reporters ignored the recommendations in *Transforming American Education*, several groups, including some state legislators, did not. The Virginia legislature, for example, moved dramatically in 1986 to light a fire under the State Department of Education. A resolution gave the Department 200 days to develop a plan to finance and install technology in the public schools of that state.

The Virginia resolution and *Transforming American Education* crossed my desk within a week of each other. They both had noble goals. The task force report cited the immediate need to establish model schools. In my opinion, the chance of that happening was almost zero. But with the state of Virginia poised to introduce technology into the public schools, we saw a way to speed up the process by perhaps a year, two years, or three years.

We proposed a plan whereby Potomac Edison would immediately donate computers to the public schools and colleges in our Virginia service area. With the help of key legislative leaders, we quickly established a partnership with the Virginia Department of Education. We established similar partnerships in our Maryland and West Virginia service areas.

Over the past four years, Potomac Edison has spent $7 million to

place technology-based classrooms in the 23 school districts we serve in these states. Our partners—the states, the local school districts, and other businesses—joined in and added additional millions. The total effort now approaches $12 million.

The Potomac Edison service area is mostly rural. About 18 of the 23 districts we serve fit the federal definition of "Appalachia." Many of these schools are now equipped with sophisticated computers and software they would not have been able to buy themselves.

Virginia gave us another avenue to forge a partnership when it launched a statewide $10 million initiative focusing on remedial work at the sixth-grade level. The state permitted the local school districts to select the hardware and software necessary for remedial programs to help students pass what Virginia calls the Literacy Passport Test. This is a test that students take for the first time in grade six. When students pass this test, it is one signal that they have the basic literacy skills for junior high and high school — they have a passport to move to the next stage in their learning. They must earn their Literacy Passport before they can be promoted to the ninth grade.

The 10 Virginia school districts in our area decided to use the same kind of high-quality equipment and software that we had installed in our project, which made their computer expansion more expensive. But, the results were impressive.

Because our school districts in Virginia had access to so much computer equipment, they decided to teach the entire sixth grade in these

General Assembly of Virginia
1986 Session
House Joint Resolution No. 118

WHEREAS, the 1980s have seen a great rise in the importance of computers in our everyday lives; and

WHEREAS, computers have been used primarily as administrative tools in areas of student and financial accounting, reporting, research and statistical analysis; and

WHEREAS, though personal computers are now being used in many homes throughout the United States, still many school children do not have access to personal home computers because their families cannot afford them; and

WHEREAS, being very flexible instruments, computers have a definite potential for use as educational tools; and

WHEREAS, the application of computers has already been expanded to provide computer-assisted instruction within and without the classroom; and

WHEREAS, the above usage has, of necessity, called for more awareness, education and training of students and for all involved in preparing students for the future; and

WHEREAS, to facilitate the awareness, education and training required, a comprehensive and integrated state plan for instruction and for funding the purchase and replacement of equipment and software would be necessary; now, therefore, be it

RESOLVED by the House of Delegates, the Senate concurring, That the Department of Education is requested to study initiatives to advance computer-assisted instruction. It should also determine the criteria for a comprehensive state plan that would provide awareness, education and training in grades K-12, articulation between public and higher education, equity in access to computers for school children, and a funding mechanism for the purchase of hardware, software and the replacement of obsolete equipment and materials.

computer classrooms, rather than limit computer instruction to remedial students. The excellent test results that emerged from this experiment are representative of what we are now seeing in elementary mathematics in many of the 200 schools that have these classrooms.

The Evolution of Classroom Technology

These results in no way represent the end of the story. We are still in the very beginning stages of an evolutionary process. As our program evolves, we will continually improve our ability to use technology as a teaching tool to raise our standards from functional or satisfactory to excellent.

This year we are placing technology in six high school science classrooms. We are adapting a system developed during two years of research at Western Maryland College, where a professor developed a program to teach embryology with computers. You might be surprised to learn that pharmacology is taught by computer at the Harvard Graduate School of Medicine. Many high-level courses in a variety of sophisticated academic subjects are taught by computer around the nation. We want to bring that level of teaching to our high schools.

We don't have all the answers, but we will not get where we need to be in classroom technology unless we begin projects like our high school science classrooms and stick with them while we learn. This is the same type of evolutionary process we went through over a century ago in agriculture.

When the steam tractor first appeared on the scene, the farmers all said, "It'll never replace the horse. Never." In the early pulling contests, the tractor would break down and the horse would pull the tractor off as everybody laughed. But in 1902, the first gasoline tractor replaced the steam tractor. A few visionary farmers saw the power and the potential of the tractor, and they began experimenting. Before very long, the laughter died away, and eventually the plowhorse disappeared from the farms.

Here's where we are in educational technology today. We have just gotten our 1903 tractor —a sensational development—in the form of the network classroom. It provides the feedback on the individual student that gives the teacher the ability to set a special program for each child. But there is still a long way to go, because this is a truly evolutionary process.

Today, our colleges are developing computers that can recognize speech. Imagine the potential of such technology! I was talking to a legislator from Arkansas who said they are thinking about integrating detection of learning disabilities right into the first grade. The computer with its ability to make thousands of decisions per second is a tremendous diagnostic tool. You can diagnose in such a way that the child doesn't even realize that he is being tested, so there is no tension. The child enjoys the experience, and teachers gain new insights into how to best help the child.

Outside Pressure To Bring About Change

Because education is a monopoly, with a bureaucratic culture highly resistant to change, it will take pressure from groups outside of education to get where we need to go. One of the reasons I feel very comfortable serving on both the higher and public education boards in Maryland is that I spent my life working for an electric utility. Utilities are monopolies that also have cultures very highly resistant to change. I understand how challenging it is to reform such organizations.

The pressure for change must come from legislators and governors, from business leaders, and from parents. What should legislators do? First, if you haven't already done it, examine the Virginia resolution—improve on it if you can and adopt it in your state. Light a fire under your state department of education.

Get out and visit technology-based classrooms and talk with the teachers. If you are convinced that investment in such classrooms

will pay off, then appropriate funds earmarked for classroom technology—preferably a multi-year commitment using general tax revenues. In Maryland, the State Board of Education has requested $11 million a year to fund this effort for four years.

I realize that money is in very short supply, and many legislators have great difficulty finding additional funds for classroom technology. I believe that business partnerships can be very helpful in this area. The minimum you should do is to pass a law guaranteeing that if business funds significant technology, you will match it at some level—perhaps $2 for every dollar of theirs, or perhaps dollar for dollar. Create a strong incentive for business to get involved. And I think you should go beyond that.

Creative "Penny a Day" Financing

I believe that you should look closely at an approach that in effect mandates a partnership between utilities and the state. I am proposing an idea inspired by a program we have used successfully in the Potomac Edison service region. It's a novel alternate financing method—what I would consider "off the book" funding for mandatory partnerships.

Here is how I imagine the method would work: Legislatures would require all regulated utilities to increase their billing by between two-tenths and three-tenths of one percent and put the extra cash into an interest-bearing account under utility control—to be used solely to buy computer technology for the schools. The initial goal would be to put a 30-station network classroom with mathematics software in every elementary school in your state.

At Potomac Edison, we funded our program at five-tenths of a percent of retail revenues. That was using money from just one utility. If you include all of the regulated utilities, you can drop that to about two-tenths of a percent.

There is a psychological line that I believe you would be wise not to cross. I would suggest you structure your legislation so that residential customers pay less than a penny a day in additional costs. That's the way we did it, and on a number of occasions when I was under attack by an irate citizen for using rate revenues to fund computers, I was able to say, "This is costing you less than a penny a day." Believe me, that was very helpful.

I believe that your utilities can be convinced of the wisdom of this program. The future of regulated industries depends on the future of their service territories. When schools fail, and business and industry falters, utilities will suffer as well. These regulated industries can't run

"Legislatures would require all regulated utilities to increase their billing. . .and put the cash into an interest-bearing account ...to be used solely to buy computer technology for the schools."

away. They are there for life. So the visionary utility executive will understand the program is in the company's best interest over the long term. And as the program succeeds, utility executives will have the added benefit of good public relations in an industry that doesn't always enjoy them.

How will private business and industry react to such a plan? I must tell you a story from my own experience. In one of Potomac Edison's service areas, we have an aluminum reduction plant paying $60 million a year for electricity. I was worried, because a half-percent increase meant $300,000 to them. When we met with the public service commission staff, the plant officials were present, and I fully expected them to shoot down the plan. Instead, they not only agreed to the proposal, but they went out and

bought several computers for classrooms near their plant—a remarkable example of corporate responsibility.

States Must Develop Long-Range Plans

Too few states are committed to long-range plans to incorporate technology into classrooms. That is because there is no guaranteed annual source for revenue for funding computers. With mandated utility participation, I believe this could change. But the money should not be distributed to schools until a plan is developed, and your plan must include money for teacher training.

We found that adequate teacher training can run about 25 percent of the hardware and software cost. Training funds should be distributed through the state department of education and designated for the sole purpose of training teachers in the use of the new technology. At Potomac Edison, we went a step further. We built a training center at our corporate headquarters in Hagerstown, Maryland. The center is equipped with every type of computer and computer network and contains thousands of pieces of software. Teachers throughout our three states receive formal training there.

We found that even this was not enough. So we also equipped a mobile van with a 30-station classroom that could be set up in minutes. The van travels throughout our rural area for PTA meetings, for training, for demonstration purposes, for introducing technology, and to begin to generate grassroots pressure on the politicians for computers in the schools. We set the van up at fairs, and thousands of people came to see what the school classroom could—and should—be.

> "The center is equipped with every type of computer and computer network and contains thousands of pieces of software."

The van was very helpful in building support for the idea, but even the van was not enough to meet the teacher training need. So we hired a full time educator in each state we serve—Maryland, Virginia, and West Virginia—to travel to the schools. When a teacher had a problem, our goal was to solve that problem within 24 hours. We have now trained more than 2,000 teachers. There is no turning back in our service territory.

A Rural Success Story

I want to close by telling one story about a boy named Joey who lived in the mountains. In these small mountainous counties, the perception has always been that the public school system is not very good. Persons who have the money often send their children to private schools. This tremendous infusion of technology into these rural schools has changed that perception. Today the public schools are perceived as being superior to private schools. There is a slow migration of students back to the public schools.

Joey was one of the students whose parents took him out of private school and brought him back to the public schools. He ended up in the eighth grade at Rappahannock County Junior High School, where he first encountered CAD—Computer Assisted Design—software. Architects use CAD routinely these days; in fact, all major corporations have gotten rid of their traditional drafting departments. Nobody works at a board anymore—everything is done by computer.

CAD gave Joey the vehicle to express the tremendous creativity lurking inside of him. Joey got so good at computer design that near the end of the year, his teacher decided to enter him into the regional CAD championship. Joey won the regionals. He went on to the state competition and became the Virginia champion. Joey's academic success raised a lot of eye-

brows, because Rappahannock County had never won a state championship before in their history—in academics or athletics.

I got a card from Joey just the other day, and he thanked Potomac Edison for putting in the CAD system. He signed the card: "Joey, United State Junior High School CAD Champion." He had won the national championship.

I believe that Joey is just the first. If we continue this infusion of technology into these 23 school districts, eight years from now students are going to come down out of the mountains who have spent a significant part of every one of their 12 years being individually tutored in this classroom. They are going to set standards of excellence never before seen in their respective states.

We have no choice but to infuse this technology into the classroom. The cost is nothing compared to the eventual cost of doing nothing. Many of the states served by the Southern Regional Education Board have their own Rappahannock counties, and they have often dreamed of catching up with the rest of the world. By establishing technology-oriented schools, your Rappahannock counties will no longer have to play catch-up. By investing now and remaining committed to the process, you can leap ahead. And I believe that I have suggested at least one viable, realistic approach to financing such an endeavor.

Elmer Kaelin invites legislators, members of state boards of education, other education leaders, public service commissioners and staff, and business leaders who are interested in these ideas to contact him directly by writing to him at 277 Potomac Heights, Hagerstown, MD 21740.

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